(ISSN 0097-4463)

ANNALS
of CARNEGIE MUSEUM

CARNEGIE MUSEUM OF NATURAL HISTORY

4400 FORBES AVENUE • PITTSBURGH, PENNSYLVANIA 15213

VOLUME 49 7 JULY 1980 ARTICLE 6

TWO NEW SPECIES OF *ELEUTHERODACTYLUS* (AMPHIBIA, ANURA, LEPTODACTYLIDAE) FROM HISPANIOLA

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ABSTRACT

Two new species of the Antillean *ricordi* group of frogs of the genus *Eleutherodactylus* are described from northwestern Haiti.

INTRODUCTION

The herpetofauna of extreme northwestern Hispaniola, especially that portion comprising the Haitian Presqu'île du Nord Ouest, is exceptionally poorly known. Other than W. L. Abbott in 1917, W. J. Eyerdam in 1927, W. G. Hassler in 1935, and J. D. Lazell and A. S. Rand in 1960, I know of no others who have made herpetological collections to the west of a line between the cities of Gonaïves in the south and Port-de-Paix in the north. That the area is one with a varied fauna was demonstrated by Lazell (1961); he named *Sphaerodactylus shrevei* and noted the occurrence there of three other genera of reptiles. Previous collectors likewise had been successful in collecting interesting and significant material from this general region, and several new subspecies have been described therefrom. That area is one with a varied fauna was demonstrated by Lazell (1961); he named *Sphaerodactylus shrevei* and noted the occurrence there of three other genera of reptiles. Previous collectors likewise had been successful in collecting interesting and significant material from this general region,

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Submitted for publication 20 November 1979.

and several new subspecies have been described therefrom. The area is one of great interest and potential. But the major problem has been—and continues to be—one of transportation. Other than the main but unpaved road between the vicinity of Gonaïves and Port-de-Paix on the northern coast, and a disreputable road from Port-de-Paix to Môle St. Nicholas on the extreme western tip of the peninsula, a distance of 73 km, all other roads in this region are exceptionally bad and subject to the vagaries of weather; when there is heavy rain, the roads are impassable, even in a 4-wheel drive vehicle.

During June and July 1978, Eugene D. Graham, Jr., William W. Sommer, and I learned that a new route has been established to Môle St. Nicholas; the new road (actually a refurbished version of an old but virtually impassable road) departs from an intersection called Ça Soleil just to the east of Gonaïves and travels thence to the town of Anse Rouge, then turns north to Jean Rabel and then west once more to Môle St. Nicholas. In 1978 we traveled as far as the town of Coridon on the southern shore of the peninsula; the road was passable and extremely productive as far as herpetological materials were concerned. Among other animals, a new species of *Eleutherodactylus* (Schwartz, 1979*a*), a new species of *Leiocephalus* (Schwartz, 1979*b*), and two new species of *Sphaerodactylus* (Schwartz and Graham, 1980; Graham, MS) were secured. It seemed likely, however, that we were, on this southern coast, merely at the edge of what may be a Presqu'île du Nord Ouest herpetofauna.

Also in 1978, Graham and I made several trips to Port-de-Paix. Most of the road from Carrefour Joffre (the intersection of the Gonaïves-Cap-Haïtien main road and the road to Port-de-Paix) passes through xeric regions, but at its northern extremity, near Port-de-Paix, the region is mesic with *caféières* and banana groves, virtually at sea level. Among other specimens collected in this latter region were three juvenal specimens of *Eleutherodactylus,* which I left unassigned specifically until more material should become available.

During June through August 1979, one of our objectives was to attempt to sample this northwestern region more thoroughly. Through the courtesy of Father John Breslin who resides at Môle St. Nicholas, John C. Lucio and William W. Sommer were able to spend six days there. Their collection includes two specimens of *Eleutherodactylus,* the first reported from this far northwestern area. One is *E. inoptatus* Barbour, not unexpected, and the other is described in the present paper. Additionally, in July, David C. Leber, S. Craig Rhodes, Lucio, and I spent three days at Port-de-Paix and were successful in securing three adult specimens of the frog of which we had three juveniles from the previous summer. This suite of six specimens likewise represents a second new species from this region. Despite these sallies into the

northwest, I feel strongly that there is still very much to learn about this remote region's herpetofauna. But the road situation continues to be very bad, and it may be even worse since the passage of Hurricane David in September 1979. This hurricane passed over the northwestern portion of Haiti and crossed the Windward Passage to Cuba.

SYSTEMATIC ACCOUNTS

The first of the new species I take great pleasure in naming after John C. Lucio, as

Eleutherodactylus lucioi, new species

Holotype.—Carnegie Museum of Natural History (CM) 60537, an adult male, from Rivière Côtes de Fer, 11.2 km NE Môle St. Nicholas, Département du Nord Ouest, Haiti, taken 8 July 1979 by William W. Sommer. Original number Albert Schwartz Field Series (ASFS) V49833.

Definition.—A moderately sized (24 mm snout-vent length) species of *Eleutherodactylus* of the *ricordi* group, characterized by golden brown dorsal color and pink hindlimbs, virtually without dorsal pattern except for a vague dark gray interocular bar, a broken gray scapular chevron, a black to dark gray canthal line that does not extend above the tympanum, concealed surfaces of hindlimbs flecked with pale gray, without supra-axillary on inguinal glandular areas, and digital discs very small.

Distribution.—Known only from the type-locality.

Description of holotype.—A presumably adult male with a snout-vent length (all measurements in millimeters) of 23.6, head length 8.7, head width 8.5, longitudinal diameter of tympanum 1.7, longitudinal diameter of eye 3.2, distance from naris to anterior corner of eye 2.6, femur 9.8, tibia 11.8, fourth toe 10.0, tibia/snout-vent length (×100) 50.0. Head width slightly narrower than distance from snout to posterior border of tympanum; snout more or less acuminate but with nares conspicuous at anterior ends of canthus rostralis; diameter of eye greater than distance from naris to anterior corner of eye; interorbital distance 3.2, equal to diameter of eye; diameter of tympanum much less than diameter of eye, distance from tympanum to eye equal to about one-third diameter of tympanum. Fingers moderate, unwebbed, 3-4-2-1 in order of decreasing length; subarticular tubercles white, almost concolor with palmar surface, prominent; disc of finger 3 equal to about one-quarter size of tympanum. Toes moderate, unwebbed, 4-3-2-5-1 in order of decreasing length; subarticular tubercles white in contrast to grayish plantar surface; disc of toe 4 small, equal to about one-sixth size of tympanum. Heels overlap slightly when femora are held at right angles to body axis. Dorsum smooth to very weakly tuberculate; throat and venter smooth, the latter becoming granular posteriorly, belly disc poorly developed. Dorsal surface of all limbs smooth; posterior face of thighs with low, small, pavement-like granules. Inguinal and supra-axillary glandular areas absent. Tongue small, not nicked, free behind, its greatest width equal to about one-quarter the floor of the mouth. Prevomerine teeth in two long arched series (extending from outside the external margin of the choanae and lying immediately adjacent to their

posterior margins) that are separated medially by a distance equal to less than the diameter of a choana.

Coloration of holotype (in life).—Dorsum golden brown and virtually patternless except for: a vague medium gray irregular interocular bar followed by two grayish paramedian blotches, a broken medium gray scapular "chevron" composed of two irregular and disjunct blotches; a black to dark gray canthal line that disappears or is only very vaguely indicated posterior to the eye as a supratympanic grayish area; hindlimbs very pale pink, the concealed surfaces vaguely marbled with medium gray; venter white. The collector noted that the specimen appeared translucent in the illumination of a flashlight; this is easily understood when one takes into consideration the extreme reduction of dark pigmentation of any sort. The general appearance of *E. lucioi* is a very pallid frog with hardly any dark markings (Fig. 1). Preserved, the dorsum shows some darkening dorsally, this dark stippling due to the chromatophores that contributed to the golden brown dorsal color.

Comparisons.—No other Hispaniolan *Eleutherodactylus* shows the combination of characters that are typical of *E. lucioi*. The pale dorsal coloration and the pink hindlimbs at once set it off from all other species. Its nearest relative, geographically, is *E. grahami* (Schwartz, 1979*a*), from the south side of the Presqu'île du Nord Ouest; a distance of some 75 km airline separates the type-localities of the two species. Within this distance lies the Massif du Nord Ouest, a mountain range that rises to an elevation of 902 m. *Eleutherodactylus grahami* and *E. lucioi* are similar in some ways, but the dorsal ground color of the former is yellowish tan in contrast to golden brown in *E. lucioi*. In addition, the dorsal and lateral dark markings are much more pronounced in *E. grahami* than in *E. lucioi,* and the former lacks the pink hindlimbs of the latter. The holotypes (and only known specimens) of the two species are both males, with that of *E. grahami* slightly larger (25.0) than that of *E. lucioi*. The head of *E. grahami* is distinctly broader than long and the snout is truncate, whereas that of *E. lucioi* is longer than broad and the snout is acuminate. The heels of *E. grahami* are widely separated when the femora are held at right angles to the body axis, whereas the heels overlap in this position in *E. lucioi*. The prevomerine teeth in *E. grahami* extend from just inside the external margin of the choanae and are separated from the choanae, whereas these teeth in *E. lucioi* extend beyond the external margin of the choanae and are appressed against their posterior margins. The tibia/snout-vent length ratio is 44.0 in *E. grahami* and 50.0 in *E. lucioi*; long series may show overlap in this ratio. Although both species are pale, *E. grahami* is more heavily and distinctly patterned dorsally than is *E. lucioi*. I have little doubt that *E. grahami* and *E. lucioi* are closely related; they likely represent a local radiation of the *ricordi* group on the Presqu'île du Nord Ouest.

Remarks.—The holotype of *E. lucioi* was taken on a rock approximately 0.7 m above the stream and projecting from the bank. The Rivière Côtes de Fer in this area is shallow and rock-strewn and varies

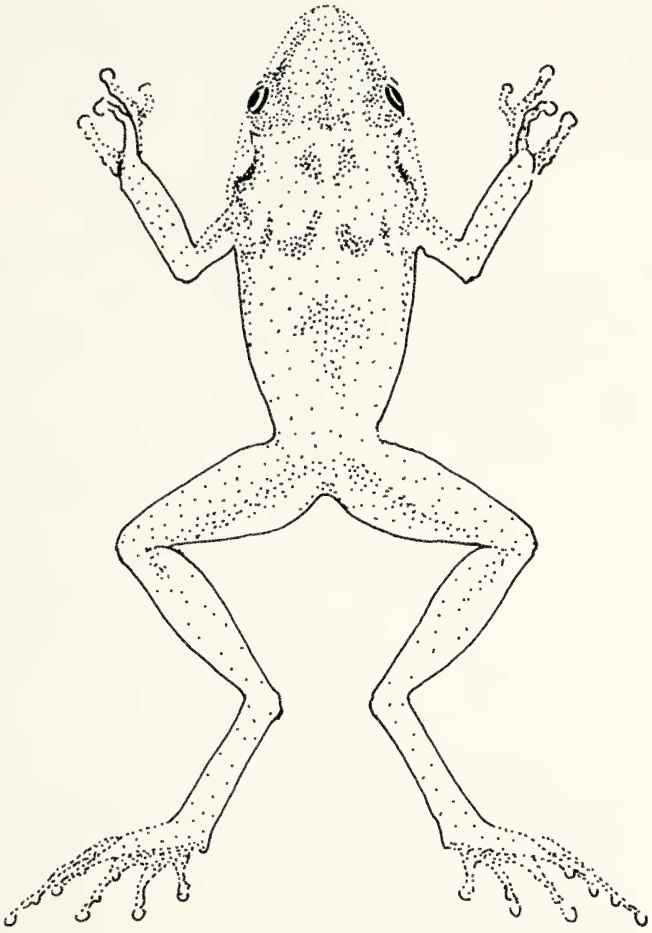

Fig. 1.—*Eleutherodactylus lucioi* (CM 60537, holotype), dorsal view; snout-vent length 23.6 mm.

from 1 to 2 m in width. The single *E. inoptatus* was taken at the same locality; no other frogs were seen.

Although the absence of webbing in *E. lucioi* suggests that it is not associated with water (that is, it is not aquatic), the taking of the holotype in a mesic stream ravine indicates the harsh arid ecology of the Môle St. Nicholas area. Outside the ravine, the area is xeric with creviced and pocked boulders. One should also note that the holotype of *E. grahami* was also taken from a very specialized situation (adja-

cent to a cave in otherwise xeric environs). These frogs may well be locally common under the right circumstances of diurnal cover and moisture, but they may be absent from large regions in the northwest where their requirements simply are not met.

The second species from near Port-de-Paix I take pleasure in naming, for S. Craig Rhodes, as

Eleutherodactylus rhodesi, new species

Holotype.—CM 60538, an adult female, from Balladé, 8.8 km S Port-de-Paix, 30 m, Département du Nord Ouest, Haiti, taken 18 July 1979 by native collectors. Original number ASFS V50029.

Paratypes.—ASFS V50030–31, same data as holotype; ASFS V46935–37. 8.0 km SE Port-de-Paix, Dépt. du Nord Ouest, Haiti, E. D. Graham, Jr., and native collectors, 19 July 1978.

Definition.—A moderately sized (30 mm) species of *Eleutherodactylus* of the *ricordi* group, characterized by olive dorsum, much overlaid by dark gray to black pigment in the form of a large, prominent, broad scapular chevron, often attached to an interorbital dark triangle with its apex pointed posteriorly, a pair of clear olive dorsolateral lines, the remainder of the dorsum mottled or blotched with gray to black, including the snout anterior to the interocular bar or triangle; hindlimbs including concealed surfaces stippled with black, forming a loose series of transverse crossbands on the thighs and crura, without supra-axillary or inguinal glandular areas, and digital discs absent.

Distribution.—Known only from the vicinity of the type-locality.

Description of holotype.—An adult female, oviducts enlarged and convoluted, with a snout-vent length of 29.8, head length 10.8, head width 11.0, longitudinal diameter of tympanum 2.7, longitudinal diameter of eye 3.5, distance from naris to anterior corner of eye 3.3, femur 12.6, tibia 13.4, fourth toe 11.0; tibia/snout-vent length (×100) 45.0. Head width slightly greater than distance from snout to posterior border of tympanum; snout truncate with nares conspicuous at anterior ends of canthus rostralis; diameter of eye longer than distance from naris to anterior corner of eye; interorbital distance 3.7, slightly greater than diameter of eye; diameter of tympanum less than diameter of eye, distance from tympanum to eye equal to about one-third diameter of tympanum. Fingers (right hand injured) moderate, unwebbed, 3-4-2-1 in order of decreasing length; subarticular tubercles concolor with palmar surface, not prominent, gray, but well developed; terminal dilation of finger 3 about one-eighth size of tympanum, not well developed. Toes moderate, unwebbed, 4-3-5-2-1 in order of decreasing length; subarticular tubercles concolor with plantar surface, dark gray, inconspicuous but well developed; terminal dilation of toe 4 equal to about one-eighth size of tympanum. Heels widely separated when femora are held at right angles to body axis. Dorsum smooth; throat and venter smooth, belly disc not well developed. Dorsal surfaces of all limbs smooth to very slightly tuberculate; posterior faces of thighs with low, small, pavement-like granules. Inguinal and supra-axillary glandular areas absent. Tongue large, only slightly nicked, free behind, its greatest width equal to about three-quarters floor of mouth. Prevomerine teeth in two long arched series, almost touching medially, their lateral ends extending lateral to the choanae and appressed against them.

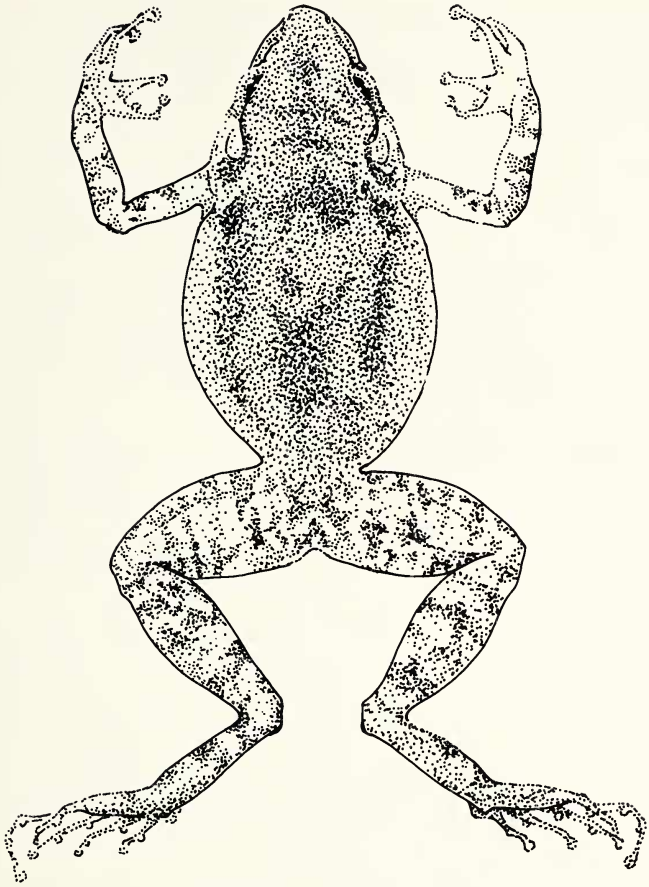

Fig. 2.—*Eleutherodactylus rhodesi* (CM 60538, holotype), dorsal view; snout-vent length 29.8 mm.

Coloration of holotype (in life).—Dorsum olive but greatly overlaid by dark gray to black markings, leaving only a pair of dorsolateral stripes clear olive; a large dark scapular chevron or blotch, extending laterally beyond (ventrad to) the dorsolateral stripes to behind the tympanum; an interocular dark triangle, its apex pointed posteriorly, attached to a diffuse dark area that in turn attaches to the scapular figure. Snout dusky olive without distinct dark markings; remainder of dorsum and sides overlaid with dark gray to blackish marblings, these darkest and most confluent lateral to the dorsolateral lines; lores dark gray; a dark supratympanic line with a dark extension to the center of the tympanum (Fig. 2); ventral ground color flesh colored, the throat evenly and discretely stippled with fine black dots, these dots also occurring on the sides of the belly; both fore- and hindlimbs banded dorsally, the bands most obvious on the ante-

brachium, those on the thighs and crura indicated but disrupted, the upper surface of the pes likewise crossbanded, the plantar surfaces very dark gray; concealed surfaces pale gray with black bars; iris bronzy above and brownish red below.

Variation.—The series of *E. rhodesi* consists, in addition to the holotype, of three juveniles with snout-vent lengths from 11.9 to 19.9, a male with a snout-vent length of 26.1, and a female with a snout-vent length of 23.0. The testes of the male suggest that it is an adult; the ovaries of the female are not enlarged nor are the oviducts convoluted and enlarged, suggesting that it is a non-breeding or subadult individual. Measurements of the male are: head length 9.7, head width 9.7, tympanum 2.2, eye 3.9, naris to eye 3.2, femur 11.8, tibia 13.2, fourth toe 11.3. Measurements on the second female are: head length 9.2, head width 9.0, tympanum 2.2, eye 2.6, naris to eye 2.8, femur 10.9, tibia 11.6, fourth toe 9.3. Tibia/snout-vent length ratios (×100) for the entire series are 45.0–50.6. The holotype has the lowest ratio, the male paratype the highest.

The patterns of the paratypes are very like that of the holotype, except that the juveniles are more distinctly patterned. In them, the dorsal ground color was yellow, and all dorsal markings were black, so that they are more contrastingly patterned than are the subadult and adults. The most consistent (and often darkest—ASFS V50030) dorsal pattern element in adults is the scapular chevron and its lateral extension below the dorsolateral pale lines. The dark interocular bar or triangle may be broadly confluent with the scapular chevron (ASFS V46936), and the snout may be as marbled or stippled as the dorsum itself. The ventral ground color was recorded in the juveniles as pearly white and in the adults pale gray to flesh. Limb crossbanding is somewhat more discernible in young individuals, but in subadults it tends to become blurred and fragmented; the concealed surfaces are always gray with black barring or marbling. The black discrete stippling on the throat is a constant feature.

Comparisons.—Eleutherodactylus rhodesi in many ways resembles *E. weinlandi* Barbour and *E. pictissimus* Cochran, as well as *E. probolaeus* Schwartz. The latter two species are far removed geographically from the known stations for *E. rhodesi*: *E. pictissimus* occurs on the Hispaniolan south island and *E. probolaeus* on the extreme southeastern portion of Hispaniola in the República Dominicana (see Schwartz, 1965:111, and 1976:23–26, for details). Of these two species, *E. rhodesi* most closely resembles *E. probolaeus* in pattern, but the two species differ in dorsal ground color (olive in *E. rhodesi,* tan in *E. probolaeus*) and in details of dorsal pattern. Hind leg ratios are 50.8–51.7 in male *E. probolaeus,* 50.6 in the one male *E. rhodesi.* Although they are related (in that both are members of the *ricordi* group), it would seem most likely that the similarities in pattern are convergent. *Eleutherodactylus rhodesi* is a shorter-limbed frog (heels do not touch) than *E. probolaeus* (heels touch); the latter is an inhabitant of semimesic limestone ridges, removed some 500 km from *E. rhodesi.*

Since Port-de-Paix lies directly opposite the satellite Ile de la Tortue, which is inhabited by *E. warreni* Schwartz, comparisons of *E. rhodesi* with that species are pertinent as well. *Eleutherodactylus warreni* is about the same size (males to 26, females to 33) as *E. rhodesi,* but the two are differently colored dorsally (yellow-brown to medium brown in *E. warreni,* olive in *E. rhodesi*), and *E. rhodesi* is by far the more heavily patterned (see Schwartz, 1976:17). The dorsal markings in *E.*

warreni are a much dissected dark interocular bar and the remnants of a scapular chevron (both pattern features well delineated in *E. rhodesi*), as well as a few other scattered dark spots or blotches. Limb markings in *E. warreni* are much reduced, in contrast to the boldly marked limbs of *E. rhodesi*. *Eleutherodactylus warreni* has small but obvious digital discs, whereas these are lacking in *E. rhodesi*. I suspect that *E. warreni* is most closely related to *E. rhodesi*, but to regard them as subspecies obscures the very obvious differences between them.

Most pertinent are comparisons with *E. weinlandi*. In fact, the similarities between the three 1978 juveniles and juvenal *E. weinlandi* were one factor in not naming the species at that time (the fact that all three specimens were juveniles was, however, the overriding consideration). To understand this problem completely, I must briefly review the situation with *E. weinlandi* in northern Haiti. Although this species is predominantly Dominican in distribution, there has been one Haitian station (*ca.* 2 km inland from Anse à Margot, Dépt. du Nord) with a good representation of indisputable *E. weinlandi*. This locality is only 45 km east of the type-locality of *E. rhodesi*. There has also been but a single specimen from Cap-Haïtien between Anse à Margot and the Dominico-Haitian border. This individual is puzzling; it has been described in detail (Schwartz, 1976:29–30). In 1978 and 1979, we were successful in securing series of *E. weinlandi* on the northern versant of the Massif du Nord, north of Dondon. These specimens confirm the presence of the species in the presumed hiatus whence specimens had been lacking. In addition, these frogs differ from their relatives to the east (*E. w. weinlandi*) in the República Dominicana. All of these facts had to be taken into consideration before I felt secure in naming *E. rhodesi*; too many pieces of the puzzle had been missing.

Eleutherodactylus rhodesi differs from Haitian *E. weinlandi* in two obvious ways—in the latter there is always a blotch of reddish, orange, or brick color in the sacral region, and the entire dorsum as well as the hindlimbs are overlaid heavily with black so that very little of the dorsal tan ground color is visible. Schwartz (1965:Fig. 93) has a dorsal view of Dominican *E. w. weinlandi*. This illustration shows clearly, when compared with Fig. 2 in the present paper, the striking pattern differences between these two taxa. These pattern differences, plus the more drab dorsal color of *E. rhodesi*, make it clear that the latter is a species distinct from *E. weinlandi*. Tibia/snout-vent length ratios in both sexes of *E. w. weinlandi* vary between 41.9 and 55.1, in contrast to 45.0 to 50.6 in all *E. rhodesi*. Adult *E. w. weinlandi* are larger (to 36 mm) than female *E. rhodesi*.

Remarks.—All but one specimen of *E. rhodesi* were native-collected under trash in a mesic *Musa* grove. The exception is a juvenile taken by Graham from under dry leaves on a slope adjacent to a dry drainage

ditch. Because much of this area south and southeast of Port-de-Paix is mesic, I presume that the frogs are relatively common under these mesic cultivated surroundings, but native collectors were hard to encourage to collect frogs in the Balladé region.

Acknowledgments

Without the assistance of Eugene D. Graham, Jr., John C. Lucio, S. Craig Rhodes, and William W. Sommer, the material reported in the present paper would be much less than it is. Lucio and Sommer spent six days at Môle St. Nicholas through the offices of Father John Breslin, to whom I am also grateful. All of the above deserve my sincere appreciation for their assistance, cooperation, and companionship in the field in Haiti during 1978 and 1979. Comparative material was collected in part under the auspices of National Science Foundation grants G-7977 and B-023603 to the author. Illustrations are from the pen of Beryl Bayer, who also deserves my sincere thanks.

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